

Physics and Statistics Based Selection of SLM and EBM Process Parameters to Mitigate Defects and to Control Deposit Microstructure, Phase II

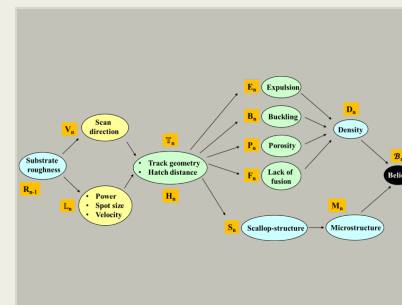
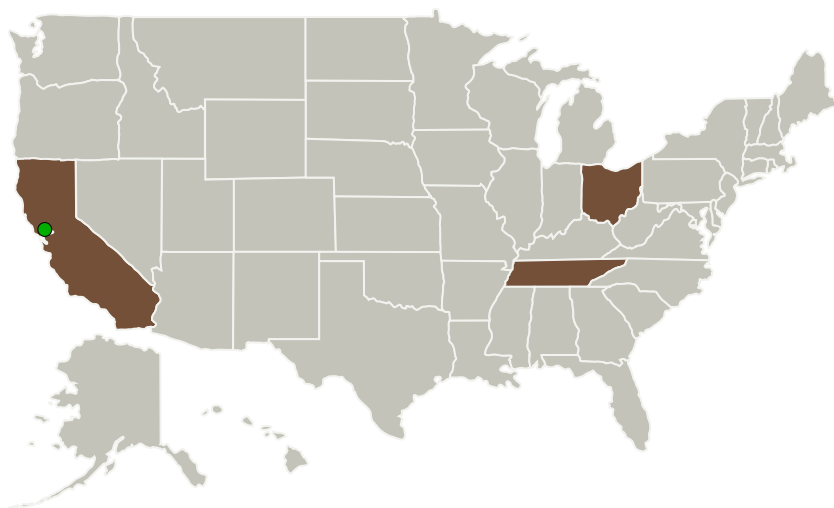
Completed Technology Project (2015 - 2017)



Project Introduction

The ability to assign a level of confidence for build quality is fundamental to the deployment of powder bed technology. Accordingly, the research objective of this work is to use probability theory as a glue to combine the physics-based models used for the selection of processing parameters together in order to produce quality deposits using the following approach: (1) Use probability theory as the glue to combine physics-based models for melt-pool thermal-fluid behavior and track cross-section formation in order to determine the deposition parameters; (2) Enhance the physics-based model to predict vaporization and expulsion of the additive material, melt pool buckling, transport of gas bubbles, determination of hatch distance, inter-track and inter-layer wetting; (3) Perform probabilistic assessment for the performance of the deposition parameters for their ability to mitigate defects, attain consistency of size for the fused tracks, flatness of the top layer, and the material microstructure; (4) Use the solidification parameters and thermal cycling during deposition to predict the precipitation reactions; (5) Perform deposition experiments to demonstrate the ability to engineer the deposition parameters. This work would result in reduction of effort for the development of process parameters and part qualification for specialty materials of interest to NASA.

Primary U.S. Work Locations and Key Partners



Physics and Statistics Based Selection of SLM and EBM Process Parameters to Mitigate Defects and to Control Deposit Microstructure, Phase II Briefing Chart Image

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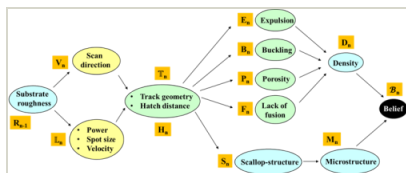


Organizations Performing Work	Role	Type	Location
Applied Optimization, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Fairborn, Ohio
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations

California	Ohio
Tennessee	

Images



Briefing Chart Image

Physics and Statistics Based Selection of SLM and EBM Process Parameters to Mitigate Defects and to Control Deposit Microstructure, Phase II Briefing Chart Image (<https://techport.nasa.gov/image/133748>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Applied Optimization, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

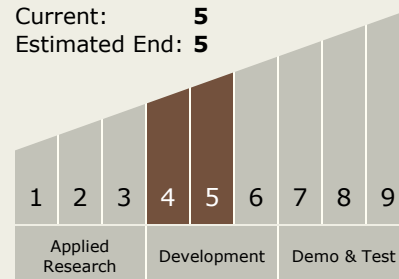
Carlos Torrez

Principal Investigator:

Anil B Chaudhary

Technology Maturity (TRL)

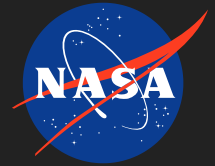
Start: 4
Current: 5
Estimated End: 5



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Microstructure, Phase II

Completed Technology Project (2015 - 2017)



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.4 Manufacturing
 - └ TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System